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RFID-Solution for Optimizing the Logistic of an Assembly Line for Agricultural Machinery

M. Baldinger[1]

Summary

The aim of this paper is to demonstrate how the new highest technology can be used to develop and optimize the manufacturing plant. Based on the results of a preliminary study and other observations made during the last year, it was decided to bring a new technology in its factory. On the basis of climbing demand and the ever bigger nascent variety with the production of self loading wagons, the machine-factory is modernized by a mounting-street for self loading wagons. The use of RFID-technology, tied into an ERP-System, led to a clear optimization of the production-process.

Introduction

An elevated transparency, a current feedback of the assembly advance and a preparation of reliable production data are the catch phases for an efficient assembly line. In the framework of the rebuilding of the assembly line of the self loading wagons, an initiative was started to the optimization of the job-referential production of different loading wagons. Concretely, following goals were pursued with this initiative:

- An elevated transparency along the production-process
- A current feedback of the current production- and assembly-advance
- A preparation of reliable production-data for the sale - and shipping-department
- A focusing of the worker on the assembly-activities

In combination with an Intranet as well as Internet link, there will be an easy operation and administration of the system. Comparing the costs as well as the savings of such an example in dependence of the increase of the productivity, the investigation of such a system calculates itself.

To this purpose, an automated data-recording was required in the production. A touch-less RFID-technology (radio frequency identification) should come to use.

Initial situation

The purpose of the use of a RFID-system at the assembly line is the documentation of the production-advance and in further consequence a production-near, automated advance-degree-booking during the assembling of the self loading wagons.

In the existing situation, an entire production-job of a self-loading wagon is dispatched into the ERP-System and the parts for the assembling will be reserved in the store. Parts, that would be required also at other assembly lines for further

[1]Alois Pöttinger Maschinenfabrik GmbH., Industriegelände 1, 4710 Grieskirchen, Austria

products, cannot be accessed by the reservation of the total of a production-job. The back posting of the manufactured self loading wagon takes place intermittently at the end of the assembly line and the stock will be updated.

The RFID-technology should deliver a production-near back posting of the production-advance to the ERP-System with a discharge of the stock in dependence to the actual production-step.

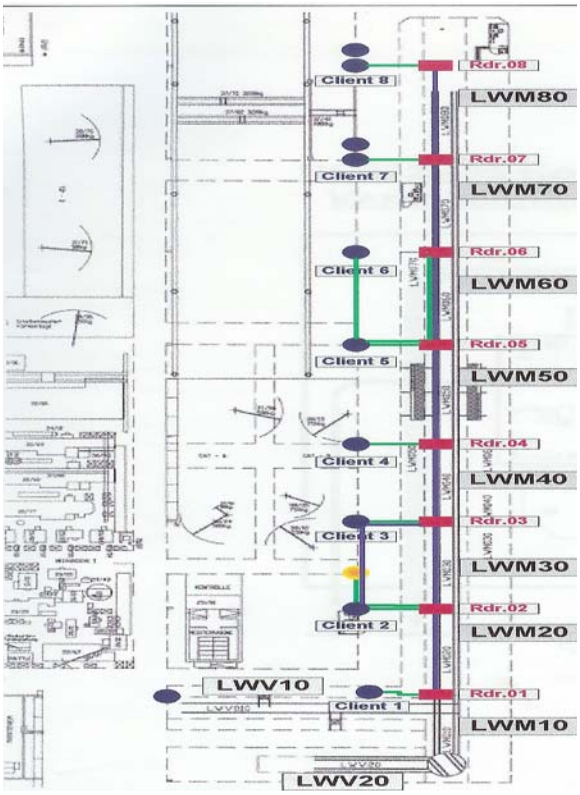


Figure 1: Layout of the assembly line

General survey - system solutions

In the first workstation of the assembly line, the self loading wagons are equipped with a RFID-transponder, on which the job-number is stored. On the basis of the predominate environment-conditions and to the guarantee of a long durability, special capsuled synthetic resin transponders were used. They are optimally placed on the self loading wagon on the one hand and offer a high mechanical, chemical and thermal constancy on the other hand. The attachment takes place over clip-mountings, so that a quick fastening can be enabled on the self loading wagon. Over this transponder, the self loading wagon is unequivocally marked and can be

identified contactless and fully automatically.

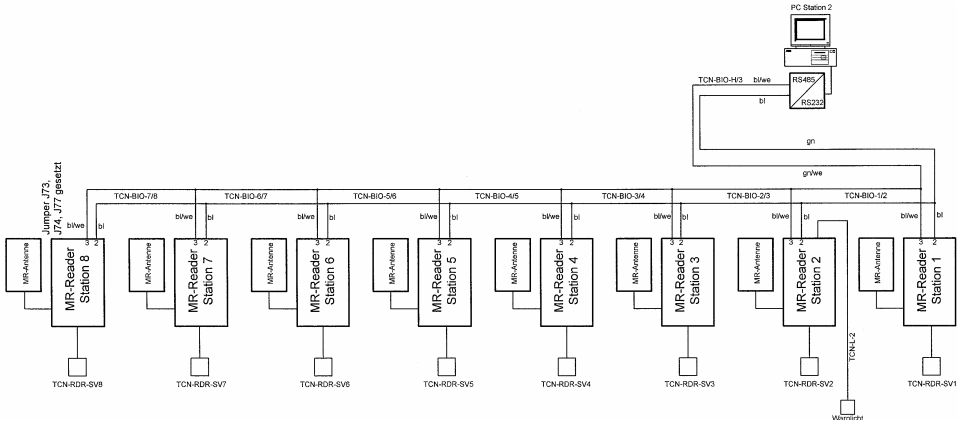
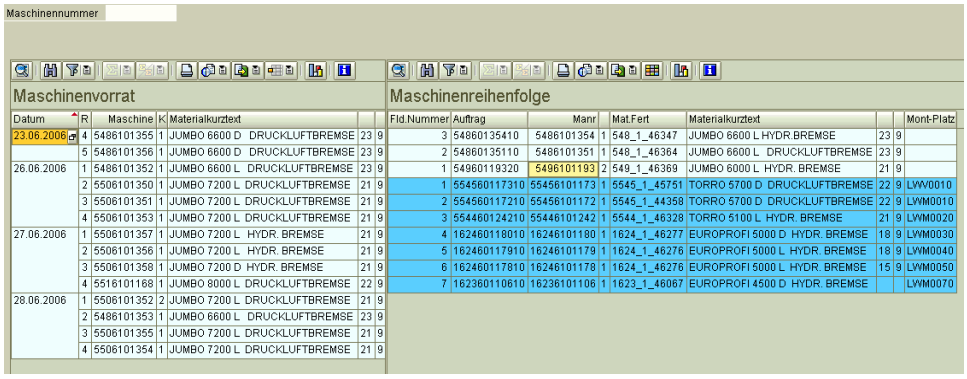


Figure 2: Progressing processes

RFID-reader and –writer are installed on the individual assembly stations, whereas the antennas are brought in into the ground. The self loading wagons go through the assembly-stations sequential afterwards.

In figure 3, one can see the detailed planning of machines. This will be dispatched by the first assembly station. The date classification is done by the customer.



Datum	R	Maschine	K	Materialkurztext		
23.06.2006	4	5486101355	1	JUMBO 6600 D DRUCKLUFTBREMSE	23	9
	5	5486101356	1	JUMBO 6600 D DRUCKLUFTBREMSE	23	9
26.06.2006	1	5486101352	1	JUMBO 6600 L DRUCKLUFTBREMSE	23	9
	2	5506101350	1	JUMBO 7200 L DRUCKLUFTBREMSE	21	9
	3	5506101351	1	JUMBO 7200 L DRUCKLUFTBREMSE	21	9
	4	5506101353	1	JUMBO 7200 L DRUCKLUFTBREMSE	21	9
27.06.2006	1	5506101357	1	JUMBO 7200 L HYDR. BREMSE	21	9
	2	5506101356	1	JUMBO 7200 L HYDR. BREMSE	21	9
	3	5506101358	1	JUMBO 7200 D HYDR. BREMSE	21	9
	4	5516101168	1	JUMBO 8000 L DRUCKLUFTBREMSE	22	9
28.06.2006	1	5506101352	2	JUMBO 7200 L DRUCKLUFTBREMSE	21	9
	2	5486101353	1	JUMBO 6600 L DRUCKLUFTBREMSE	23	9
	3	5506101355	1	JUMBO 7200 L DRUCKLUFTBREMSE	21	9
	4	5506101354	1	JUMBO 7200 L DRUCKLUFTBREMSE	21	9

Fld.Nummer	Auftrag	Manr		Mat.Fert	Materialkurztext			Mont-Platz
3	54860135410	5486101354	1	548_1_46347	JUMBO 6600 L HYDR.BREMSE	23	9	
2	54860135110	5486101351	1	548_1_46364	JUMBO 6600 L DRUCKLUFTBREMSE	23	9	
1	54960119320	5496101193	2	549_1_46369	JUMBO 6000 L HYDR. BREMSE	21	9	
1	554560117310	55456101173	1	5545_1_45751	TORRO 5700 D DRUCKLUFTBREMSE	22	9	LVW0010
2	554560117210	55456101172	1	5545_1_44358	TORRO 5700 D DRUCKLUFTBREMSE	22	9	LVM0010
3	55446124210	55446101242	1	5544_1_46328	TORRO 5100 L HYDR. BREMSE	21	9	LVM0020
4	162460118010	16246101180	1	1624_1_46277	EUROPROFI 5000 D HYDR. BREMSE	18	9	LVM0030
5	162460117910	16246101179	1	1624_1_46276	EUROPROFI 5000 L HYDR. BREMSE	18	9	LVM0040
6	162460117810	16246101178	1	1624_1_46276	EUROPROFI 5000 L HYDR. BREMSE	15	9	LVM0050
7	162360110610	16236101106	1	1623_1_46067	EUROPROFI 4500 D HYDR. BREMSE			LVM0070

Figure 3: Stock of machines

As soon as the self loading wagon comes in into one of the assembly stations, it is identified automatically over the transponder and the job order-number will be reported to the ERP system. Therefore it is deposited, which self loading wagon is to which time at which station.

The worker receives all necessary information over work-steps and mounting parts on a display automatically, see figure 4.

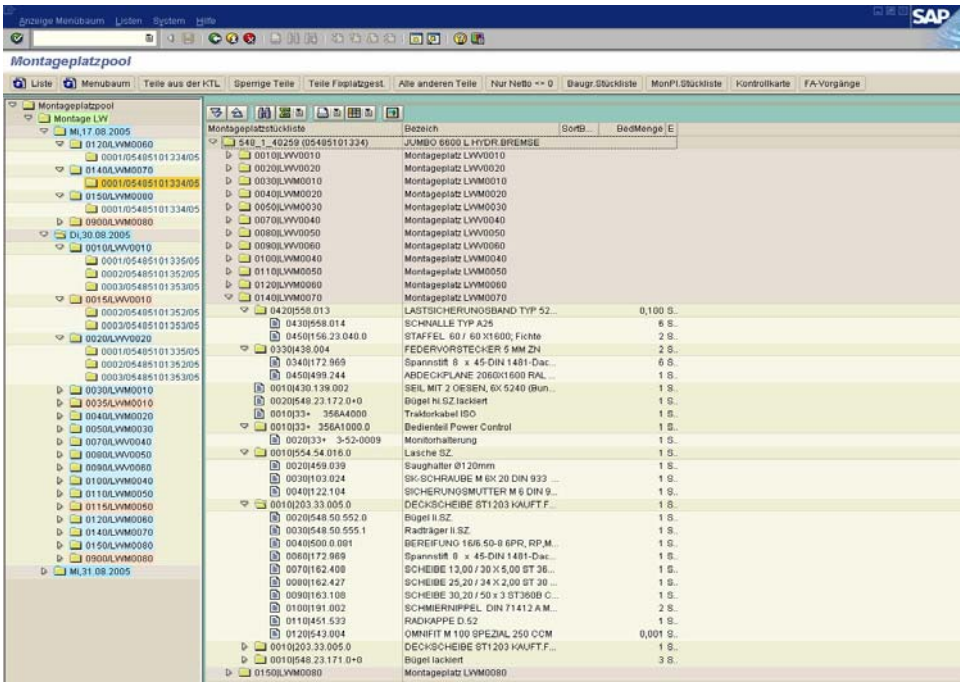


Figure 4: Assembly station pool

Also drawings can be represented on the display.

As soon as the worker has performed his activities, the self loading wagon leaves the assembly station. This also becomes detected through the RFID transponder and an automatic debit of the object list in the ERP-system is nudged. Possible deviations are corrected manually by the worker.

Still, also the run-time is measured over the radio frequency identification system in the individual assembly workstation, that is drawn near for statistical evaluations and optimization-measures.

Conclusion

An advanced management approach including contactless identification is extended with the highest technical standards. The system solution was presented and explained by means of different views. The repertoire is concluded by the possibility of the viewing of the mounted parts. The accessibility to existing databases automatized in full brings the data afterwards directly into the ERP-system without any expenditure. Also the integration into an intranet as well as the application of a automatic post mortem analysis refer to a further important milestone into a fully automated solution.

One can summarize:

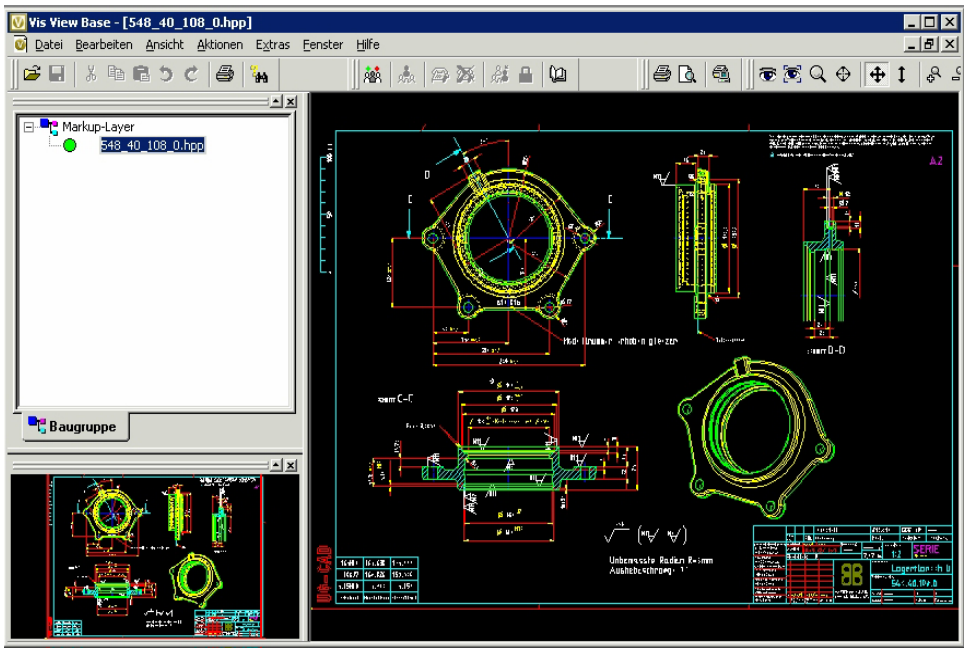


Figure 5: Viewing picture

- Automatic reply of the degree of production in real-time
- Updating of the actual stock in real-time
- High level of transparency and retraceability
- Increase of availability of the parts through an actual stock
- Statistical evaluations for machining and cycle time

Put together, the proposed approach may lead to an optimal assembly process control program, based upon specific solutions such as connection between to different sub systems (ERP and stand alone software), Integration into existing software and the use of the newest technique on the sector of RFID.

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